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**Digital cellular telecommunications system (Phase 2+) (GSM);
General Packet Radio Service (GPRS);
Overall description of the GPRS radio interface;
Stage 2
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Contents

Intellectual Property Rights	2
Legal Notice	2
Modal verbs terminology.....	2
Foreword.....	7
1 Scope	8
2 References	8
3 Abbreviations, symbols and definitions	9
3.1 Abbreviations	9
3.2 Symbols.....	11
3.2a Restrictions.....	11
3.2b Definitions.....	11
3.3 Network and mobile station capabilities	11
3.3.1 General.....	11
3.3.2 EGPRS mobile station	12
3.3.3 Dual Transfer Mode.....	12
3.3.4 Downlink dual carrier configuration.....	12
3.3.5 Reduced Latency TBF	12
3.3.5.1 Fast Ack/Nack Reporting procedure	12
3.3.5.2 RTTI configuration	13
3.3.6 EGPRS2 mobile station	14
3.3.6.1 EGPRS2 in the downlink	14
3.3.6.1.1 EGPRS2-A and EGPRS2-B in the downlink.....	14
3.3.6.2 EGPRS2 in the uplink	14
3.3.6.2.1 EGPRS2-A and EGPRS2-B in the uplink.....	14
3.3.7 Downlink multi carrier configuration	14
3.3.8 Power Efficient Operation (PEO)	15
3.3.8.1 General	15
3.3.9 Extended Coverage GSM for Internet of Things (EC-GSM-IoT)	16
3.3.9.1 General	16
3.3.9.2 Extended coverage	17
3.3.9.2.1 General	17
3.3.9.2.2 Extended coverage improvement for MS with low output power.....	17
3.3.9.3 Energy efficient operation.....	18
3.3.9.4 Improved security	18
3.3.9.5 Restricted Use of Enhanced Coverage	19
3.3.10 Overlaid CDMA	19
4 Packet data logical channels.....	20
4.1 General	20
4.2 Packet Common Control Channel (PCCCH) and Compact (CPCCCH)	20
4.2.1 Packet Random Access Channel (PRACH) and Compact Packet Random Access Channel (CPRACH) - uplink only	20
4.2.2 Packet Paging Channel (PPCH) and Compact Packet Paging Channel (CPPCH) - downlink only	20
4.2.3 Packet Access Grant Channel (PAGCH) and Compact Packet Access Grant Channel (CPAGCH) - downlink only	20
4.3 Packet Broadcast Control Channel (PBCCH) and Compact Packet Broadcast Control Channel (CPBCCH) - downlink only	20
4.4 Packet Traffic Channels	21
4.4.1 Packet Data Traffic Channel (PDTCH, EC-PDTCH).....	21
4.5 Packet Dedicated Control Channels	21
4.5.1 Packet Associated Control Channel (PACCH, EC-PACCH)	21
4.5.2 Packet Timing advance Control Channel, uplink (PTCCH/U).....	21
4.5.3 Packet Timing advance Control Channel, downlink (PTCCH/D)	21
4.6 MBMS Common Control Channels	21
4.6.1 MBMS Packet Random Access Channel (MPRACH) - uplink only.....	21

5	Mapping of packet data logical channels onto physical channels	22
5.1	General	22
5.2	Packet Common Control Channels (PCCCH and CPCCCH)	23
5.2.1	Packet Random Access Channel (PRACH and CPRACH)	23
5.2.2	Packet Paging Channel (PPCH and CPPCH)	23
5.2.3	Packet Access Grant Channel (PAGCH and CPAGCH)	23
5.2.4	Void	24
5.2a	MBMS Common Control Channels (MPRACH)	24
5.2b	Extended Coverage Common Control Channels (EC-CCCH)	24
5.2b.1	General	24
5.2b.2	Extended Coverage Random Access Channel (EC-RACH)	24
5.2b.3	Extended Coverage Paging Channel (EC-PCH)	24
5.2b.4	Extended Coverage Access Grant Channel (EC-AGCH)	24
5.3	Packet Broadcast Control Channel (PBCCH and CPBCCH)	24
5.3a	Compact Frequency Correction Channel (CFCCCH)	25
5.3b	Compact Synchronization Channel (CSCH)	25
5.3c	Extended Coverage Broadcast Control Channel (EC-BCCH)	25
5.4	Packet Timing advance Control Channel (PTCCH)	25
5.5	Packet Traffic Channels	25
5.5.1	Packet Data Traffic Channel (PDTCH)	25
5.5.1a	Extended Coverage Packet Data Traffic Channel (EC-PDTCH)	26
5.5.2	Packet Associated Control Channel (PACCH)	26
5.5.2a	Extended Coverage Packet Associated Control Channel (EC-PACCH)	26
5.6	Downlink resource sharing	27
5.7	Uplink resource sharing	27
6	Radio Interface (Um)	27
6.1	Radio Resource management principles	27
6.1.1	Allocation of resources for the GPRS	27
6.1.1.0	General	27
6.1.1.1	Master-Slave concept	27
6.1.1.2	Capacity on demand concept	28
6.1.1.3	Procedures to support capacity on demand	28
6.1.1.4	Release of PDCH not carrying PCCCH	29
6.1.2	Multiframe structure for PDCH	29
6.1.2a	Multiframe structure for Compact PDCH	33
6.1.2b	Multiframe structure for PDCH/H	34
6.1.3	Scheduling of PBCCH information	34
6.1.4	SMS cell broadcast	35
6.1.5	MS Multislot Capability	35
6.2	Radio Resource operating modes	35
6.2.1	Packet idle mode	35
6.2.2	Packet transfer mode	36
6.2.3	Dual transfer mode	36
6.2.3a	Broadcast/Multicast receive mode	36
6.2.4	Correspondence between Radio Resource operating modes and Mobility Management States	37
6.2.5	Transitions between RR operating modes	37
6.3	Layered overview of radio interface	38
6.4	Physical RF Layer	39
6.5	Physical Link Layer	39
6.5.1	Layer Services	39
6.5.2	Layer Functions	39
6.5.3	Service Primitives	40
6.5.4	Radio Block Structure	40
6.5.4.1	Radio Block structure for data transfer for GPRS	40
6.5.4.2	Radio Block structure for data transfer for EC-GSM-IoT and for EGPRS with FANR not activated	41
6.5.4.3	Radio Block structure for data transfer for EGPRS with FANR activated or for EGPRS2	41
6.5.4.4	Radio Block structure for control message transfer	42
6.5.4.4.1	General format (CS-1)	42
6.5.4.4.2	Format for downlink control message for RTTI configuration (MCS-0)	42
6.5.4.4.3	Format for alternative uplink control message for DLMC configuration (CS-3)	43

6.5.4.4.4	Format for control message for EC-GSM-IoT (EC-PACCH)	43
6.5.5	Channel Coding	44
6.5.5.0	General	44
6.5.5.1	Channel coding for PDTCH.....	44
6.5.5.1.1	Channel coding for GPRS PDTCH	44
6.5.5.1.2	Channel coding for EGPRS PDTCH and EC-GSM-IoT EC-PDTCH.....	46
6.5.5.1.3	Channel coding for EGPRS2 PDTCH	53
6.5.5.2	Channel coding for PACCH, EC-PACCH, PBCCH, PAGCH, EC-AGCH, PPCH, EC-PCH and PTCCH.....	75
6.5.5.2a	Channel coding for CPBCCH, CPAGCH, CPPCH and CSCH	77
6.5.5.3	Channel Coding for the PRACH, CPRACH and MPRACH.....	77
6.5.5.3.1	Coding of the 8 data bit Packet Access Burst.....	77
6.5.5.3.2	Coding of the 11 data bit Packet Access Burst	77
6.5.6	Cell Re-selection.....	78
6.5.6.0	General	78
6.5.6.1	Measurements for Cell Re-selection	78
6.5.6.2	Broadcast Information.....	79
6.5.6.3	Optional measurement reports and network controlled cell re-selection	79
6.5.6.4	Network Assisted Cell Change	79
6.5.7	Timing Advance	80
6.5.7.0	General	80
6.5.7.1	Initial timing advance estimation	80
6.5.7.2	Continuous timing advance update	81
6.5.7.2.1	Mapping on the multiframe structure	81
6.5.8	Power control procedure	83
6.5.8.0	General	83
6.5.8.1	MS output power.....	83
6.5.8.2	BTS output power	83
6.5.8.3	Measurements at MS side	84
6.5.8.3.0	General	84
6.5.8.3.1	Deriving the C value.....	84
6.5.8.3.2	Derivation of Channel Quality Report.....	84
6.5.8.4	Measurements at BSS side	85
6.5.9	Scheduling the MS activities during the PTCCH and idle frames	85
6.5.10	Discontinuous Reception (DRX)	86
6.6	Medium Access Control and Radio Link Control Layer.....	87
6.6.1	Layer Services	87
6.6.2	Layer Functions	87
6.6.3	Service Primitives.....	88
6.6.4	Model of Operation.....	88
6.6.4.0	General	88
6.6.4.1	Multiplexing MSs on the same PDCH.....	94
6.6.4.1.1	Uplink State Flag: Dynamic Allocation	94
6.6.4.1.1.1	Multiplexing of GPRS, EGPRS or EGPRS2 MSs	94
6.6.4.1.1.2	Multiplexing of GPRS, EGPRS and EGPRS2 MSs.....	94
6.6.4.1.2	Void.....	95
6.6.4.1.3	Exclusive Allocation	95
6.6.4.1.4	Fixed Uplink Allocation (FUA)	95
6.6.4.1.4.1	Multiplexing of GPRS, EGPRS, EC-GSM-IoT and EGPRS2 MSs.....	95
6.6.4.2	Temporary Block Flow	95
6.6.4.3	Temporary Flow Identity	95
6.6.4.4	Medium Access modes	95
6.6.4.5	Acknowledged mode for RLC/MAC operation	96
6.6.4.5.1	GPRS	96
6.6.4.5.2	EGPRS, EGPRS2 and EC-GSM-IoT	96
6.6.4.6	Unacknowledged mode for RLC/MAC operation	97
6.6.4.6a	Non-persistent mode for RLC/MAC operation.....	97
6.6.4.7	Mobile Originated Packet Transfer.....	97
6.6.4.7.1	Uplink Access.....	97
6.6.4.7.1.1	On the (EC-)(P)RACH.....	97
6.6.4.7.1.2	On the main DCCH.....	99
6.6.4.7.2	Dynamic/Extended Dynamic allocation	100

6.6.4.7.2.1	Uplink Packet Transfer	100
6.6.4.7.2.2	Release of the Resources	102
6.6.4.7.3	Void	103
6.6.4.7.4	Exclusive Allocation	103
6.6.4.7.4a	Fixed Uplink Allocation	103
6.6.4.7.5	Contention Resolution	104
6.6.4.8	Mobile Terminated Packet Transfer	105
6.6.4.8.1	Packet Paging	105
6.6.4.8.2	Downlink Packet Transfer	105
6.6.4.8.3	Release of the Resources	108
6.6.4.8.4	Packet Paging Notification	108
6.6.4.9	Simultaneous Uplink and Downlink Packet Transfer	109
6.6.4.9.1	MS Does Not Support Multiple TBF Procedures	109
6.6.4.9.2	MS Supports Multiple TBF Procedures	109
6.7	Abnormal cases in GPRS MS Ready State	110
6.8	Void	110
6.9	MBMS Data Transfer	110
Annex A (informative): Bibliography		111
Annex B (informative): Multiple TBF Feature		112
B.1	General	112
B.2	Multiple TBF capability	112
B.3	Multiple TBF procedures	113
B.3.1	Data multiplexing options	113
B.3.1.1	Single TBF per upper layer flow	113
B.3.1.2	DL TBF sharing	113
B.3.1.3	Explicit UL TBF switching	113
B.3.2	RLC/MAC Signalling	113
B.3.3	TBF establishment	113
B.3.3.1	TFI allocation	113
B.3.3.2	Single TBF request / establishment	114
B.3.3.3	Multiple TBF establishment / reconfiguration	114
B.3.3.3.1	Multiple uplink TBF request / establishment	114
B.3.3.3.2	Multiple downlink TBF establishment	115
B.3.3.3.3	Usage of multiple TBF assignment messages	115
B.4	RLC/MAC Timers	116
B.4.1	TBF timers	116
B.4.2	Contention resolution timer	116
B.5	CSN.1 coding of multiple TBF messages	116
B.5.1	MULTIPLE TBF UPLINK ASSIGNMENT message	116
B.5.2	MULTIPLE TBF DOWNLINK ASSIGNMENT message	117
B.5.3	MULTIPLE TBF TIMESLOT RECONFIGURE message	118
Annex C (informative): Change history		119
History		124

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1 Scope

The present document provides the overall description for lower-layer functions of the General Packet Radio Service (GPRS and EGPRS) radio interface (Um). Within this TS the term GPRS refers to GPRS and EGPRS unless explicitly stated otherwise.

The overall description provides the following information:

- The services offered to higher-layer functions,
- The distribution of required functions into functional groups,
- A definition of the capabilities of each functional group,
- Service primitives for each functional group, including a description of what services and information flows are to be provided, and
- A model of operation for information flows within and between the functions.

The present document is applicable to the following GPRS Um functional layers:

- Radio Link Control functions,
- Medium Access Control functions, and
- Physical Link Control functions.

The present document describes the information transfer and control functions to be used across the radio (Um) interface for communication between the MS and the Network, see Figure 1.

3GPP TS 23.060 [3] describes the overall GPRS logical architecture and the GPRS functional layers above the Radio Link Control and Medium Access Control layer.

3GPP TS 24.007 [5] contains a description in general terms of the structured functions and procedures of this protocol and the relationship of this protocol with other layers and entities.

3GPP TS 44.018 [6] contains the definition of GPRS RLC/MAC procedures when operating on the Common Control Channel (CCCH).

3GPP TS 44.060 [7] contains the definition of RLC/MAC functions when operating on a Packet Data Channel (PDCH).

3GPP TS 44.064 [8] contains functional procedures for the Logical Link Control (LLC) layer above the RLC/MAC.

3GPP TS 45 series defines the Physical Link layer and Physical RF layer.

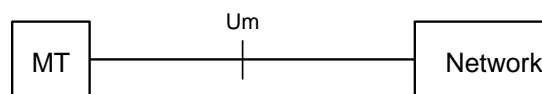


Figure 1: Scope of GPRS Logical Radio Interface Architecture

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

- [1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
- [2] 3GPP TS 22.060: "General Packet Radio Service (GPRS); Stage 2".
- [3] 3GPP TS 23.060: "General Packet Radio Service (GPRS); Service description; Stage 2".
- [4] 3GPP TS 44.004: "Digital cellular telecommunications system; Layer 1; General requirements".
- [5] 3GPP TS 24.007: "Mobile radio interface signalling layer 3 General aspects"
- [6] 3GPP TS 44.018: "Mobile radio interface layer 3 specification; Radio Resource Control Protocol"
- [7] 3GPP TS 44.060: "Radio Link Control/Medium Access Control (RLC/MAC) protocol".
- [8] 3GPP TS 44.064: "General Packet Radio Service (GPRS); Logical Link Control (LLC)".
- [9] 3GPP TS 44.065: "General Packet Radio Service (GPRS); Subnetwork Dependent Convergence Protocol (SNDCCP)".
- [10] 3GPP TS 45.001: "Physical layer on the radio path, General description".
- [11] 3GPP TS 45.002: "Multiplexing and multiple access on the radio path".
- [12] 3GPP TS 45.003: "Channel coding".
- [13] 3GPP TS 45.004: "Modulation".
- [14] 3GPP TS 45.005: "Radio transmission and reception".
- [15] 3GPP TS 45.008: "Radio subsystem link control".
- [16] 3GPP TS 45.010: "Radio subsystem synchronisation".
- [17] 3GPP TS 43.246: "Multimedia Broadcast Multicast Service (MBMS) in the GERAN; Stage 2".
- [18] 3GPP TS 23.682: "Architecture enhancements to facilitate communications with packet data networks and applications".
- [19] 3GPP TS 24.008: "Mobile radio interface Layer 3 specification; Core network protocols; Stage 3".
- [20] 3GPP TS 43.020: "Security related network functions".
- [21] 3GPP TS 48.018: "BSS GPRS Protocol (BSSGP)".

3 Abbreviations, symbols and definitions

3.1 Abbreviations

In addition to abbreviations in 3GPP TR 21.905 [1] and 3GPP TS 22.060 [2] the following abbreviations apply:

ARQ	Automatic Repeat reQuest
BCS	Block Check Sequence
BEC	Backward Error Correction
BH	Block Header
BTTI	Basic Transmission Time Interval
CC	Coverage Class
CCN	Cell Change Notification
CFCCH	Compact Frequency Correction Channel
CPAGCH	Compact Packet Access Grant Channel

CPBCCH	Compact Packet Broadcast Control Channel
CPCCH	Compact Packet Common Control Channel
CPPCH	Compact Packet Paging Channel
CPRACH	Compact Packet Random Access Channel
CSCH	Compact Synchronization Channel
CS- <i>i</i>	GPRS Coding Scheme <i>i</i>
CU	Cell Update
DAS- <i>i</i>	EGPRS2 Downlink level A modulation and coding Scheme <i>i</i>
DBS- <i>i</i>	EGPRS2 Downlink level B modulation and coding Scheme <i>i</i>
DLMC	Downlink Multi Carrier
DTM	Dual Transfer Mode
eDRX	Extended Discontinuous Reception
EC	Extended Coverage
EGPRS	Enhanced GPRS
EGPRS2	Enhanced GPRS phase 2
EC-GSM-IoT	Extended Coverage GSM for Internet of Things
EC SI	EC-GSM-IoT System Information
ESAB	Extended Synchronization Access Burst
EDAB	Extended Dual slot Access Burst
eTFI	Extended Temporary Flow Identity
FANR	Fast Ack/Nack Reporting
FBI	Final Block Indicator
FH	Frame Header
GGSN	Gateway GPRS Support Node
HCS	Header Check Sequence
HSR	Higher Symbol Rate
IR	Incremental Redundancy
LLC	Logical Link Control
MAC	Medium Access Control
MBMS	Multimedia Broadcast/Multicast Service
MCS- <i>i</i>	EGPRS Modulation and Coding Scheme <i>i</i>
MPRACH	MBMS Packet Random Access Channel
NSS	Network and Switching Subsystem
PACCH	Packet Associate Control Channel
PAGCH	Packet Access Grant Channel
PAN	Piggy-backed Ack/Nack
PBCCH	Packet Broadcast Control Channel
PC	Power Control
PCCCH	Packet Common Control Channel
PCS	PAN Check Sequence
PDCH	Packet Data Channel
PDTCH	Packet Data Traffic Channel
PDU	Protocol Data Unit
PEO	Power Efficient Operation
PFC	Packet Flow Context
PFI	Packet Flow Identifier
PL	Physical Link
PPCH	Packet Paging Channel
PRACH	Packet Random Access Channel
PSI	Packet System Information
PSM	Power Saving Mode
PTCCH	Packet Timing Advance Control Channel
p-t-m	point-to-multipoint
RLC	Radio Link Control
RTTI	Reduced Transmission Time Interval
SGSN	Serving GPRS Support Node
SNDC	Subnetwork Dependent Convergence
TA	Timing Advance
TBF	Temporary Block Flow
TFI	Temporary Flow Identity
TTI	Transmission Time Interval
UAS- <i>i</i>	EGPRS2 Uplink level A modulation and coding Scheme <i>i</i>

UBS- <i>i</i>	EGPRS2 Uplink level B modulation and coding Scheme <i>i</i>
USF	Uplink State Flag

3.2 Symbols

For the purposes of the present document, the following symbols apply:

Gb	Interface between an SGSN and a BSC.
Um	Interface between MS and GPRS fixed network part. The Um interface is the GPRS network interface for providing packet data services over the radio to the MS.

3.2a Restrictions

Independently of what is stated elsewhere in this and other 3GPP specifications, mobile station support for PBCCH and PCCCH is optional for A/Gb-mode of operation. The network shall never enable PBCCH and PCCCH.

3.2b Definitions

Blind Physical Layer Transmissions: Repetitions performed on physical layer by blindly, without feedback from the receiving end, transmitting multiple instances of the same block. To maximize the processing gain at the receiver, phase coherency at the transmitter between blind transmissions transmitted within the same TDMA frame is required, see 3GPP TS 45.005 [14].

Coverage Class: A predetermined number of blind physical layer transmissions used by Extended Coverage logical channels, EC-channels, to be able to support a certain level of extended coverage. The number of blind physical layer transmissions may differ between logical channels for the same coverage class. A Coverage Class defines a maximum coverage limit supported in EC operation, see 3GPP TS 45.005 [14]. Four Coverage Classes are defined.

EC operation: An EC-GSM-IoT capable MS in a cell supporting EC-GSM-IoT may enable EC operation, in which case CS domain services are disabled. When EC operation is enabled the MS uses FCCH and EC-SCH for synchronization purposes, EC-BCCH for acquisition of EC System Information (EC SI), EC-CCCH for monitoring EC-PCH in idle mode, EC-CCCH for packet access procedures, or, if indicated by the network CCCH, and enables relaxed mobility related requirements. In packet transfer mode the MS is assigned EC-PDTCH(s) and an associated EC-PACCH in EC TBF operation mode.

Extended coverage: Coverage level exceeding the reference sensitivity and reference interference performance of GPRS/EGPRS, see 3GPP TS 45.005 [14].

Fixed Uplink Allocation: Static allocation of resources in the uplink over one or more TTIs, using one or more PDCH, that does not make use of USF based allocation (see 3GPP TS 44.018 [6] and 3GPP TS 44.060 [7]).

Power Efficient Operation: A PEO capable MS that has successfully negotiated the use of eDRX or PSM (see 3GPP TS 23.060 [3]) may enable PEO in a cell that supports PEO in which case it enables the use of relaxed mobility related requirements (see 3GPP TS 45.008 [15]) and the use of the 'PEO One Phase Access Request'. A cell that supports PEO supports the use of relaxed mobility related requirements and EGPRS PACKET CHANNEL REQUEST messages indicating 'PEO One Phase Access Request'.

Relaxed mobility related requirements: A relaxed set of MS requirements related to mobility, used when Power Efficient Operation (PEO) or EC operation is enabled. The requirements are relaxed compared to the ones applicable for a MS that has not enabled PEO or EC operation, and include e.g. reduced monitoring of neighbour cells, reduced monitoring of System Information and less frequent triggering of measurements for cell reselection.

3.3 Network and mobile station capabilities

3.3.1 General

In addition to GPRS specific definitions which can be found in 3GPP TS 22.060 [2] and 3GPP TS 23.060 [3] the following apply.

When referring to radio resources (i.e. physical channels) provided by the network to the mobile station, the term "assignment" refers to granting of resources on a semi-static basis, whereas "allocation" refers to the dynamically changing permission to use those resources that have been "assigned" to it and are shared with other users. An exception applies when granting resources using Fixed Uplink Allocation where only the term "allocation" is used. In this case, resources are assigned and allocated by the same message.

Multislot Capability: the capability of the mobile station to support Multislot Configurations.

Multislot Class: a value which implicitly determines the Multislot Capability of the mobile station.

Multislot Configuration: the set of receive and transmit timeslots assigned to the MS.

3.3.2 EGPRS mobile station

An EGPRS mobile station is a GPRS mobile station with additional capabilities for new radio access protocol features and new modulation and coding schemes. An EGPRS mobile station shall comply with GPRS requirements and the additional requirements defined for an EGPRS mobile station. The support of EGPRS is optional for the mobile station and the network.

An EGPRS mobile station may additionally indicate support for EGPRS2 in uplink and/or downlink direction. In this case an EGPRS mobile station supports additional modulation and coding schemes, and may also support higher symbol rate, see sub-clause 3.3.6. The support of EGPRS2 is optional for the mobile station and the network.

An EGPRS mobile station may additionally indicate the support of Reduced Latency. In this case an EGPRS mobile station may be assigned a TBF with FANR activated either in BTTI configuration or in RTTI configuration, see sub-clause 3.3.5. The support of Reduced Latency is optional for the mobile station and the network.

3.3.3 Dual Transfer Mode

In dual transfer mode, the mobile station is assigned resources providing an RR connection and one or more Temporary Block Flows on one or more physical channels. This feature is optional for the mobile station and the network. It is only applicable for a mobile station supporting GPRS, EGPRS or EGPRS2. Dual transfer mode is a subset of class A mode of operation, which is only possible if there is radio resource assignment co-ordination in the network.

3.3.4 Downlink dual carrier configuration

In a downlink dual carrier configuration, one or more PDCHs are assigned to a single MS on each of two different radio frequency channels on either the uplink or downlink, or both. On the downlink, radio blocks may be allocated on both radio frequency channels in any radio block period. On the uplink, radio blocks shall not be allocated on both radio frequency channels in any given radio block period.

NOTE: A radio frequency channel in this context is defined by the frequency parameter(s) ARFCN for a non-hopping radio frequency channel or MA, MAIO and HSN for a hopping radio frequency channel.

A downlink dual carrier configuration shall support multislot configurations either for packet switched connections or dual transfer mode. For a Dual Transfer Mode capable MS which supports Downlink Dual Carrier, support of Downlink Dual Carrier configurations for Dual Transfer Mode is optional.

Downlink dual carrier is not supported in GPRS mode.

3.3.5 Reduced Latency TBF

A TBF applying Reduced Latency shall operate according to all EGPRS/EGPRS2 requirements, unless otherwise stated, with the Fast Ack/Nack Reporting procedure (see sub-clause 3.3.5.1). In addition, a TBF applying Reduced Latency is characterized by either RTTI configuration or BTTI configuration (see sub-clause 3.3.5.2).

3.3.5.1 Fast Ack/Nack Reporting procedure

The Fast Ack/Nack reporting procedure (FANR) refers to the possibility to include, in a radio block for data transfer sent in one direction, piggy-backed ack/nack information relative to a TBF with FANR activated in the other direction.